

Messages from the Draft Technical Report on Energy Transition in ASEAN Countries

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Structure of mitigation chapter of the technical report

4.1 Current status, gaps and opportunities	4.2 Model's pathways of a net-zero energy system	4.3 Feasibility analysis of power sector transition	4.4 Integrated roadmap toward net-zero power system	4.5 Enabling conditions on policy and institutions
<ul style="list-style-type: none">• Background• Regional energy landscape• Status quo and the gaps of renewable energy• Opportunities for renewable energy development	<ul style="list-style-type: none">• AIM model results (Contribution from NIES)• Long-term decarbonization scenarios depicted in other model studies (Summary of existing literature)	<ul style="list-style-type: none">• Ambition level of target setting• A case analysis of renewable energy potential• Determinant factors of renewable energy development• Phaseout/down of coal power plants• The way for gas power replacement	<ul style="list-style-type: none">• Feasibility of a net-zero power system and the technology options• Cost affordability for net-zero power system transition• The anticipated carbon prices in the future	<ul style="list-style-type: none">• Introduction• Method• Data collection• Legal and policy framework (4 countries)• Summary and recommendation



Possible pathways, feasibility and technology options for energy transition

Possible but different energy transition pathways



Possibility for net-zero

- The study for Thailand and Indonesia using AIM confirms the possibility to achieve net-zero energy-related emissions by 2050 in developing ASEAN by technology measures.
- Important to reflect the country's real conditions and necessary for communications between stakeholders and modelers.



Scenarios with high RE share

- IEA SDS Scenario: 3 times power generation of current level by 2050, and around 70% from RE.
- IRENA 1.5°C Scenario: Around 5 times of electricity demand of current level by 2050, with 90% or even 100% from RE.
- Handayani et al. (2022) NZE Scenario: By 2050, no fossil, 61% from solar PV, 17% from wind and 0.5% from nuclear.
- Thailand LTS LEDS Scenario (Updated 11/2022): For net-zero CO₂ by 2050, 74% electricity from RE and needs for BECCS.



Scenarios with moderate RE

- Kimura et al. (2022) CN50/60 Scenario: Around 3.2 times of 2017 primary energy supply by 2060, with 56% from RE (Solar PV: 53%) and 26% from H₂ and NH₃ in electricity mix.
- Indonesia LTS LCCP Scenario: By 2050: 43% from RE, 38% from coal power (76% with CCS), 10% from gas, 8% from BECCS.

Higher feasibility perceived for a balanced electricity mix

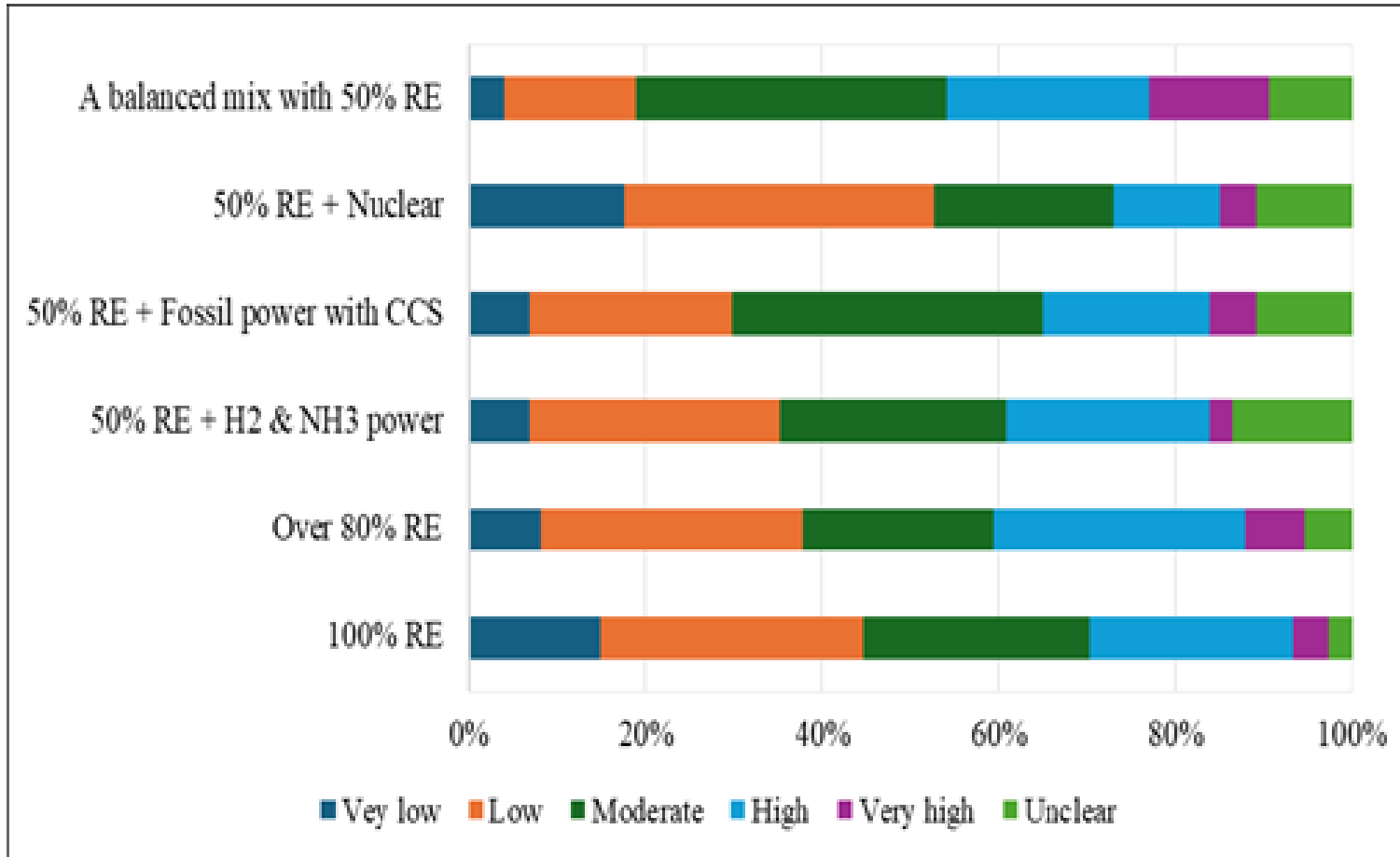


Fig.1: Feasibility of power system decarbonization options in Indonesia (N=74).

Source: Prepared by the author.

- Options with lower feasibility: A 100% renewable power system; and, 50% renewables with nuclear. (Similar in 4 countries)
- More feasible for a balanced electricity mix (i.e., with 50% RE and other carbon-free sources). (Similar in 4 countries)
- Moderate feasibility: Fossil power with CCS; and, hydrogen and ammonia power. (Indonesia and Vietnam)
- Relatively higher and almost equal feasibility: Hydrogen and ammonia-fired power; and, fossil power with CCS. (The Philippines and Thailand)

View on technology options for a net-zero power system

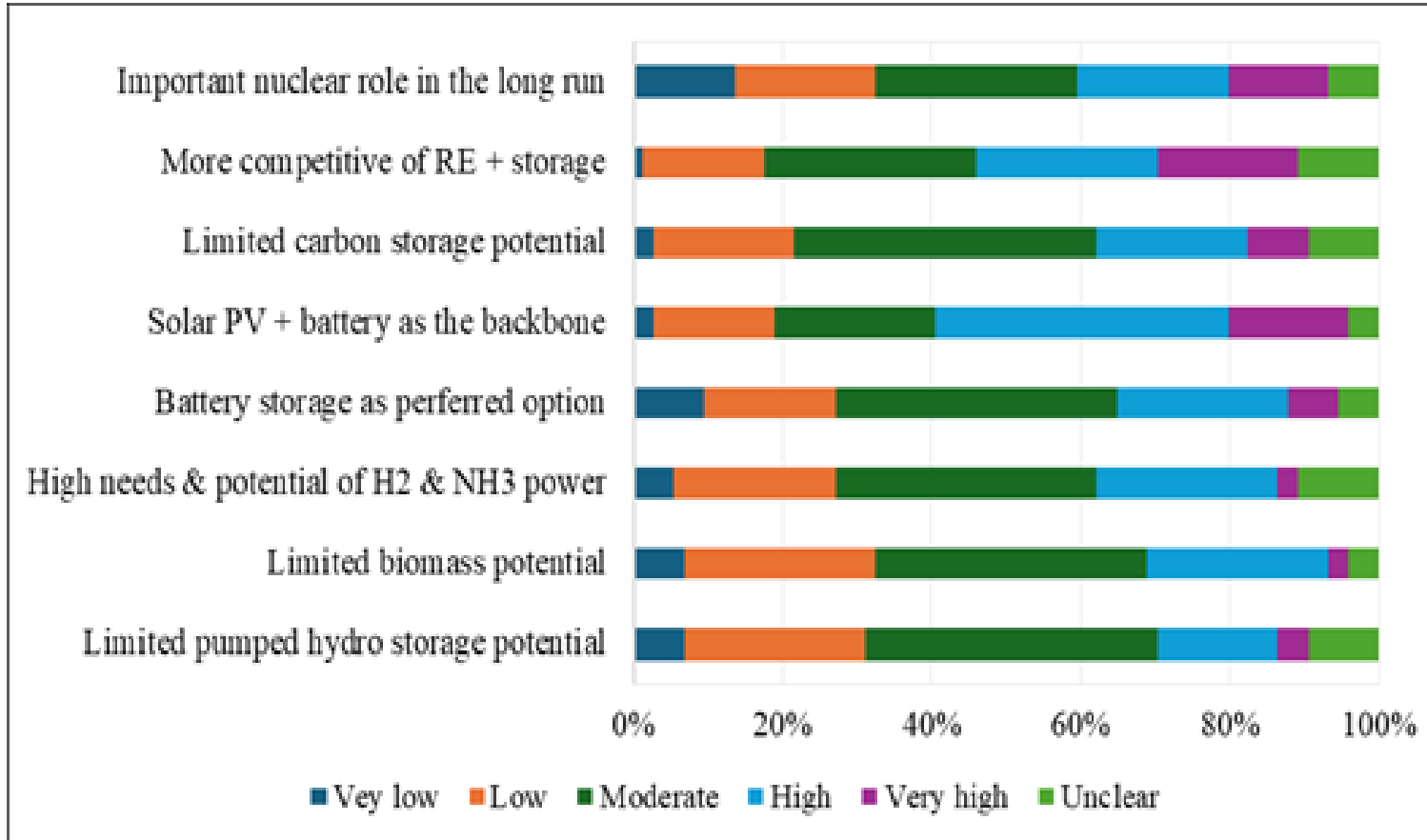


Fig.2: Agreement on technology options for power system in Indonesia (N=74).

Source: Prepared by the author.

- Wide agreement on solar PV with battery as the backbone of future power system. (Similar in 4 countries)
- Renewable energy plus storage would be more competitive. (Indonesia, Philippines and Vietnam)
- Moderate agreement on the potentials of biomass; and, pumped hydro storage. (Similar in 4 countries)
- Less agreement on the role of nuclear power in the long run. (Similar in 4 countries)
- Different agreement about the needs and potential of hydrogen and ammonia power. (Low in Indonesia but high in Thailand)



Constraints and conditions for a net-zero power system

Large potentials but various barriers for renewable energy

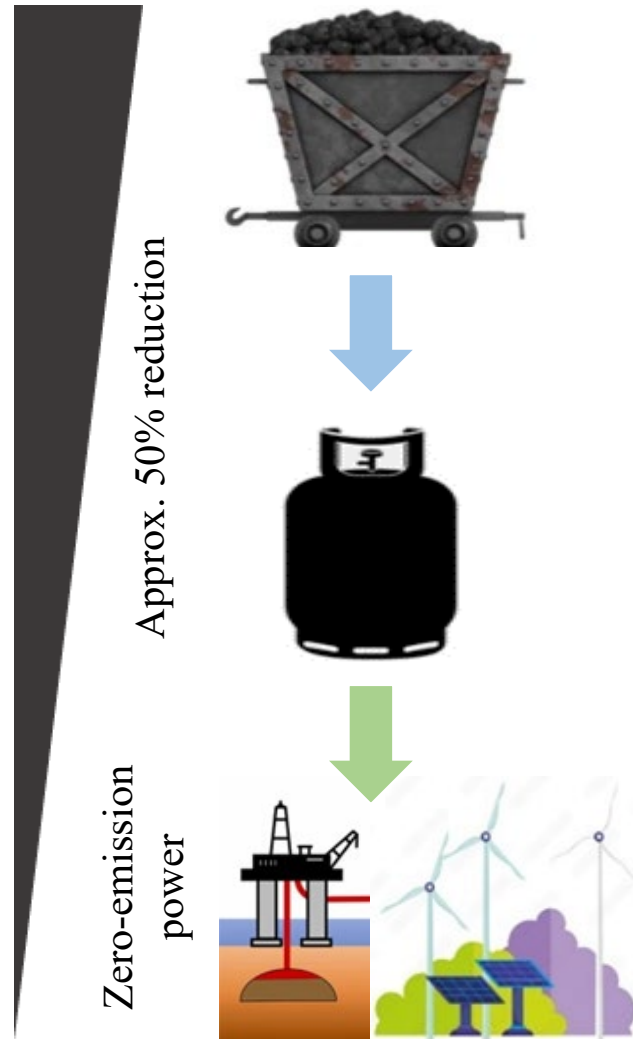


- ▣ There exist large potentials of renewable energy in ASEAN. Solar irradiance across the region is generally strong.
- ▣ This is confirmed by a case study of solar PV adoption in the building sector.
- ▣ The existence of large renewable energy potentials is well recognized by various stakeholders.
- ▣ Nevertheless, the development of renewable energy is still at an early stage in ASEAN, especially for variable renewable energy, including solar PV and wind power.



- ▣ Various barriers are largely hindering the development of solar PV and offshore wind in ASEAN countries.
- ▣ Most economic, policy and technical barriers are viewed significant.
- ▣ Economic barriers for offshore wind are higher than those for utility-scale solar PV.
- ▣ Lack of policies regulating proper land-use and environmental impact, and complex bureaucracy of power sector are also significant.
- ▣ Societal factors are viewed to be moderate or even minor.

The way for complete replacement of gas power



- To achieve zero emissions, the option is to shift to either gas-fired power with CCS, or hydrogen or ammonia power.
- There are many oil and gas fields in Indonesia, making the country a suitable place for CCS. The practical application of CCS should be accelerated by taking this advantage.
- Necessary to promote domestic production and overseas procurement of green or blue hydrogen and ammonia, and reduce the costs of hydrogen to less than 2 USD per kg.
- Carbon tax in Indonesia, currently levied on emissions from coal power plants, should be also applied to gas-fired power plants. The tax rate should be gradually increased to encourage a shift away from gas-fired power in Indonesia and other ASEAN countries.

Low cost affordability for achieving a net-zero power system

Table 1: Summary of acceptable power cost levels in 4 countries

Country	No. of samples	Cost level with high & very high acceptability (% of current level)	Cost level with moderate acceptability & above (% of current level)
Indonesia	42	95.1	107.2
Philippines	56	95.3	107.9
Thailand	39	97.3	116.8
Vietnam	36	97.1	111.3

Note: The number in parenthesis is R-squared of the simulation analysis.

- Affordability of power cost change of the Philippines is almost the same as Indonesia.
- Vietnam and Thailand may accept higher cost increases.
- Affordability of 4 countries for power cost increases would be limited, below 20% of current level.

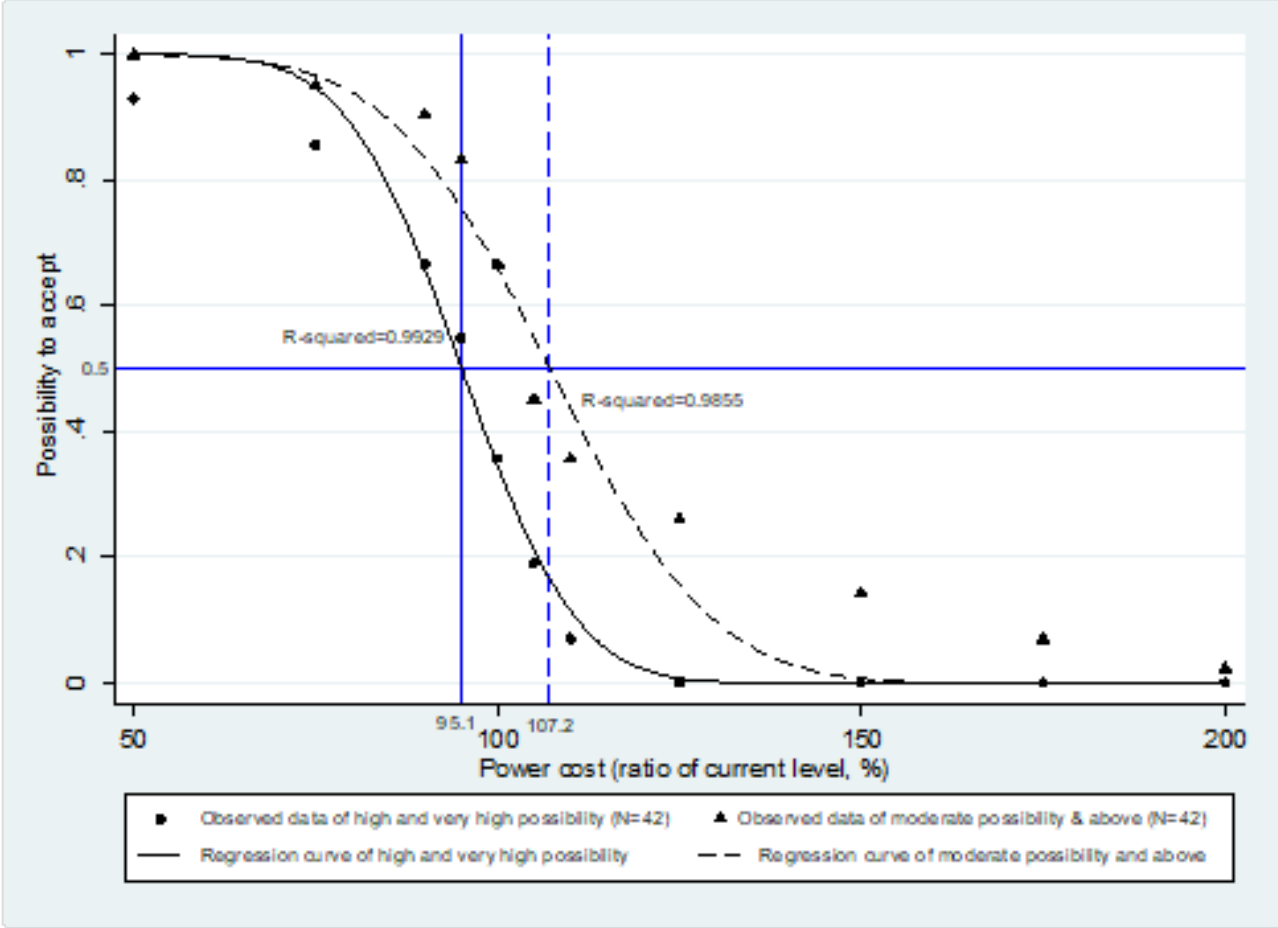


Fig.3: Possibility to accept the change of power costs in Indonesia.

Source: Prepared by the author.

Limited power generation cost changes viewed for the future

Table 2: Power generation costs predicted by 4 countries

Country	No. of samples	Power costs predicted by the samples (% of current level)		
		2030	2040	2050
Indonesia	69	84.5-125.5 (105.0)	75.6-140.5 (108.0)	57.7-169.0 (113.3)
Philippines	116	81.9-112.1 (97.0)	76.7-116.5 (96.6)	66.2-125.1 (95.6)
Thailand	57	79.7-109.7 (94.7)	72.9-116.9 (94.9)	62.3-127.4 (94.9)
Vietnam	49	92.8-112.7 (102.8)	90.9-114.5 (102.7)	87.9-117.0 (102.5)

Note: The number in parenthesis is mean of predicted costs.

- Larger uncertainty in power generation cost changes when forecasting from a longer time horizon.
- On average, Indonesia and Vietnam believe that power generation cost increase would be limited.
- The other 2 countries believe that power system transition may even help reduce power generation costs.

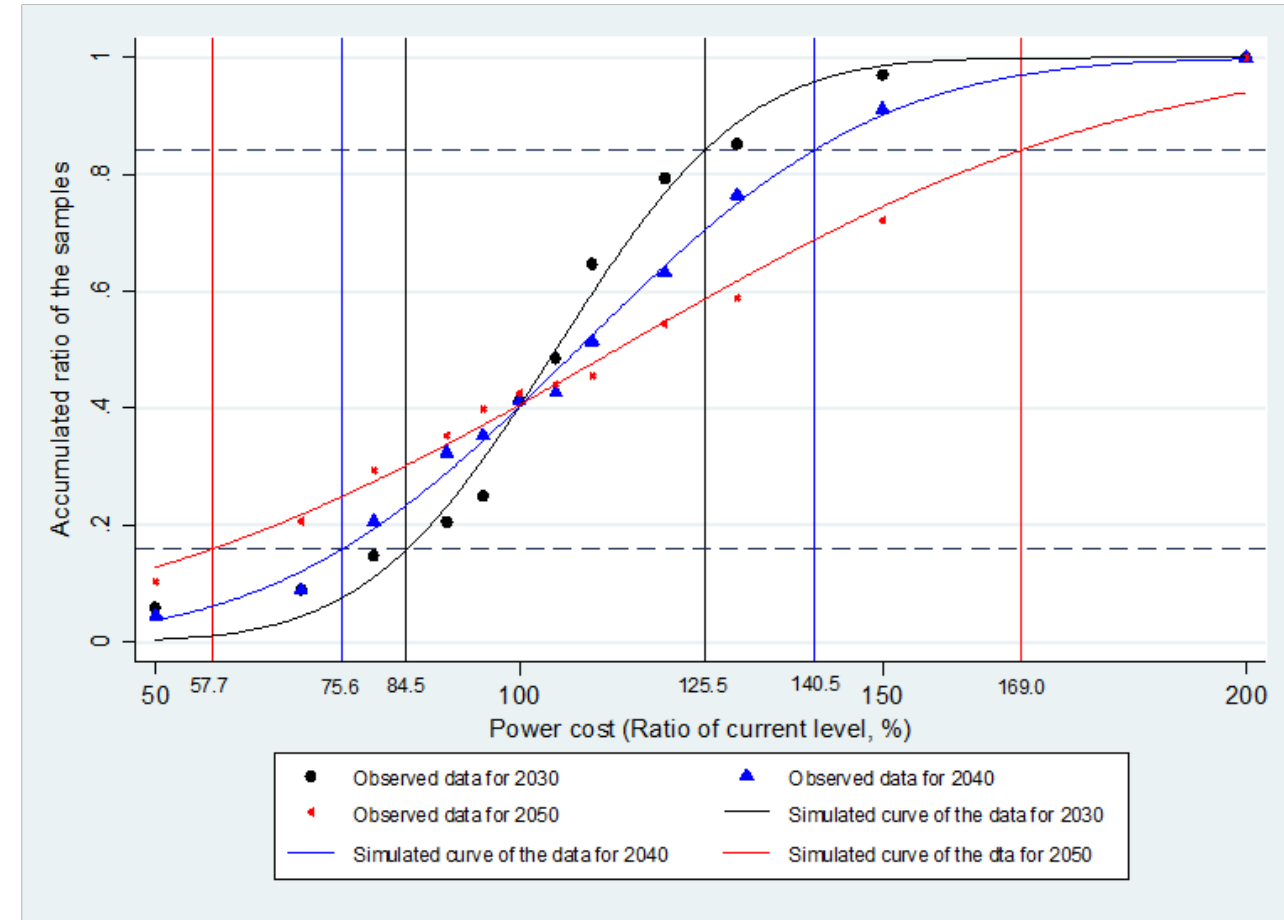


Fig.4: Future power generation cost predicted in Indonesia (N=69).

Source: Prepared by the author.

Low anticipated carbon prices for energy transition

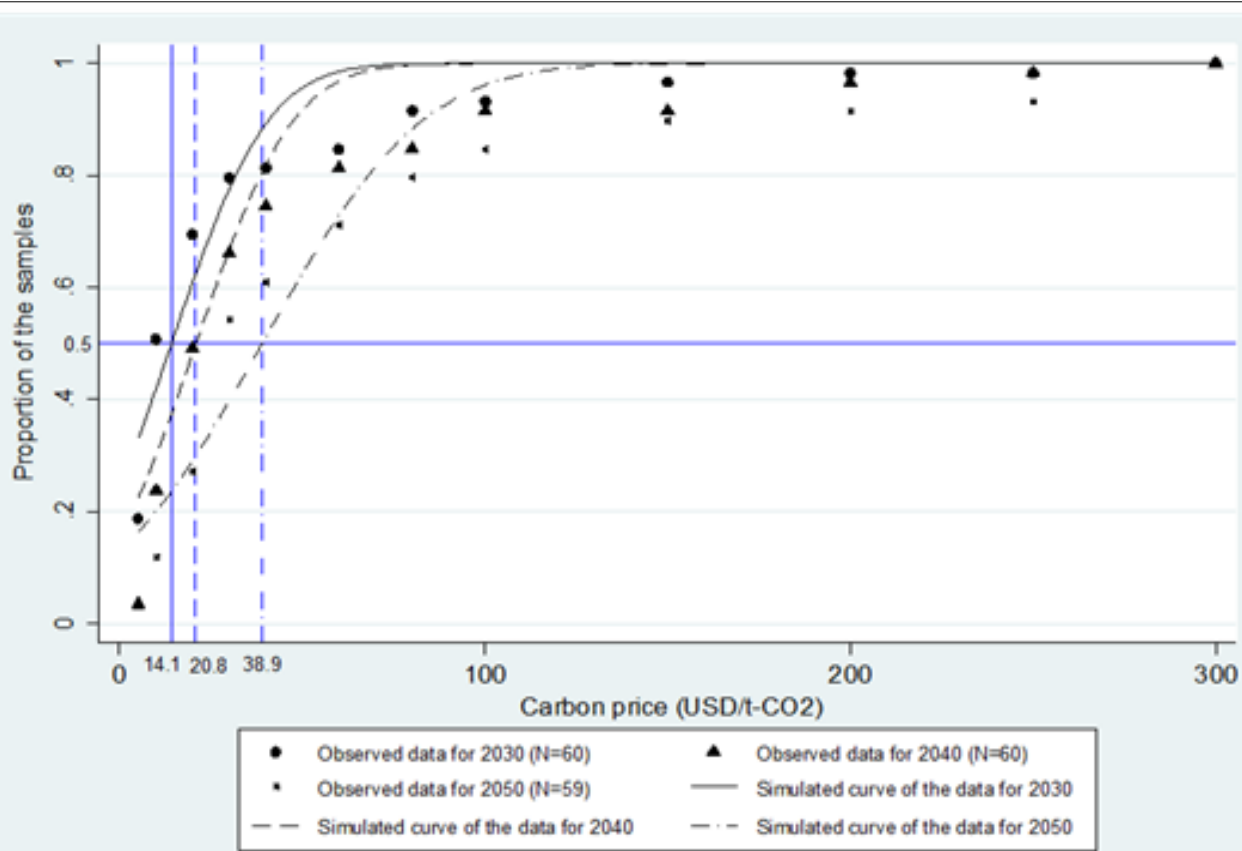


Fig.5: Future carbon prices predicted by the samples in Indonesia.

Source: Prepared by the author.

- Future carbon prices predicted in the Philippines are slightly higher than Indonesia but also limited at about 20 by 2030; 30 by 2040; and, 50 USD/t-CO₂ by 2050.
- Thailand and Vietnam achieved higher prediction of future carbon prices, to nearly 60 USD/t-CO₂ by 2050.
- Energy transition of ASEAN shall be realized by fully applying low-cost technology measures.

Table 3: Summary of predicted carbon prices in 4 countries

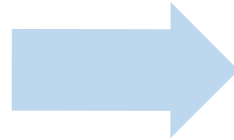
Country	No. of samples	Mean of future carbon prices predicted by the samples (USD/t-CO ₂)		
		2030	2040	2050
Indonesia	60 (59)	14.1	20.8	38.9
Philippines	110	22.8	32.7	48.0
Thailand	55	23.2	39.4	58.4
Vietnam	50 (48)	28.0	42.4	57.1

Note: The No. in the parenthesis is the No. of samples with answers for 2050.

Enabling conditions on policy and institutional frameworks

Needs and gaps

- Effective governance is crucial for net-zero transition.
- Lack of legally binding commitment generally in ASEAN countries.
- Absence of evaluation and feedback mechanisms.
- Lack of robust mechanisms using data and information from monitored results to revise and adjust policies.



Recommendations

- To integrate net-zero targets into national legislations, and utilize NDC as a mid-term milestone.
- To establish robust evaluation and feedback mechanisms in addition to MRV systems to build adaptive policy processes.
- To set up formal independent expert bodies to regularly provide objective evaluation.



*Thank you for
the kind
attention!*